Exploration of the Use of Spiking Detectors to Solve GNC Problems

Completed Technology Project (2012 - 2012)

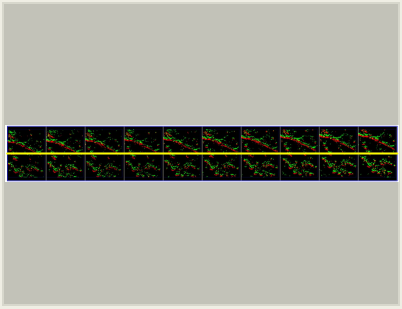
Project Introduction

This task is evaluating spiking sensor technology for Guidance, Navigation and Control applications, which includes detailed study, analysis and test for applications to star tracking, terrain tracking, and beacon tracking for optical communications and also as an optical gyro. Additionally provide an assessment for flight applications.

Our task is evaluating a specialized detector for guidance, navigation and control (GNC) applications. The detector being evaluated is a 15 microsecond Latency Asynchronous Temporal Contrast Vision Sensor, referred to as a spiking sensor. It detects change in intensity on the detector at for very high rate applications. Each pixel on the detector operates independently, and detects intensity changes on the pixel. When the change in intensity exceeds a threshold and an event is generated. The events are reported from the detector as an asynchronous stream of digital pixel addresses and time tag (to an accuracy ~10 microseconds). This results in a highly reduced set of data returned from detector. Hence, only points of interest, not image frame data is output, which reduces data volume > 100x. The device is very low power (~25mW). Since the detection of the events is done on the detector, not in a processor, the requirements on processing are reduced. Because the events are asynchronous, the timing is tied to the event, not a frame rate, such as with imagers. For GNC characterization, we performed testing on laboratory targets that included a star simulator and Mars terrain targets, as well as field testing on star patterns, planets, and International Space station (as a beacon test) passes. During the testing, we gained understanding of the details of detector biases and operations, and developed processing algorithms for clustering and noise rejection on collected data. The current detector design has high dark current and low (9%) QE; devices are in design that will give the technology a 100x SNR improvement by changes in manufacturing processes (silcon process), and front side vs backside illumination. The projection for GNC of the future device is part of this task (to be completed at end of May 2012).

Anticipated Benefits

None.



Project Image Exploration of the Use of Spiking Detectors to Solve GNC Problems

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Innovation Fund: JPL CIF

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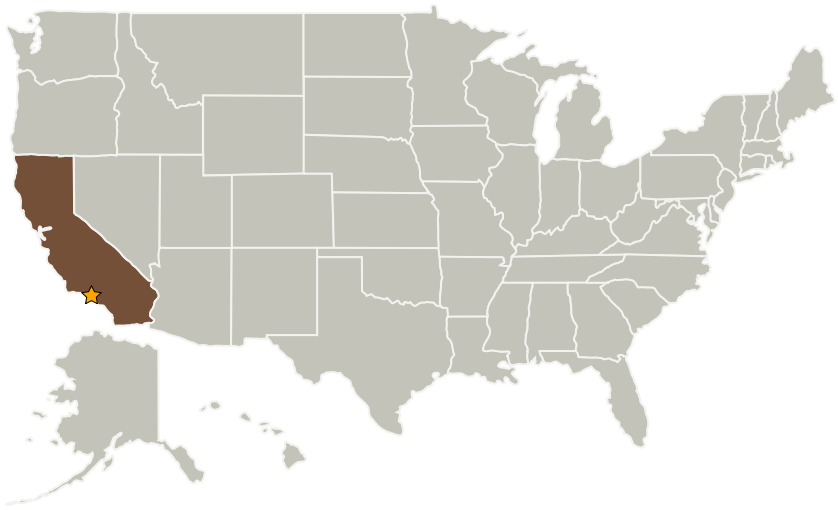
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California

Co-Funding Partners	Type	Location
ETH Zurich	Academia	Zurich, Outside the United States, Switzerland

Primary U.S. Work Locations
California

Project Management

Program Director:
Michael R Lapointe

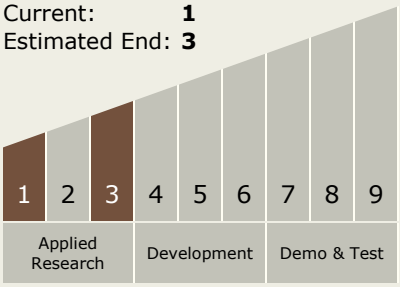
Program Manager:
Fred Y Hadaegh

Project Manager:
Jonas Zmuidzinas

Principal Investigator:
David A Alexander

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

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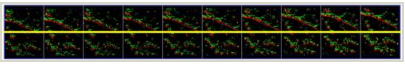
Images



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Project Image Exploration of the Use of Spiking Detectors to Solve GNC Problems
(https://techport.nasa.gov/image/1160)